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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Doane Art Unit: 2625

Serial No.: 09/746,102 Examiner: Desire, Gregory M.

Filed: 21 December 2000 Docket No. TI-23064

For: METHODS FOR MEASURING DMD LOW SPATIAL UNIFORMITY

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NAME OF INVENTOR(S): Doane	RECEIPT DATE & SERIAL NO.: Application No.: 09/746,102
TITLE OF INVENTION: Methods for Measuring DMD Low Spatial Uniformity	**Filing Date:** 12/21/2000
TI FILE NO.: TI-23064 / DEPOSIT ACCT. NO.: **20-0668**	
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APPEAL BRIEF TRANSMITTAL

22 November 2004

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Charles A. Brill — Date

Sir:

Transmitted herewith is an Appeal Brief in the above-identified application.

Please charge the $340.00 fee for filing the Brief to the deposit account of Texas Instruments Incorporated, Account No. 20-0668.

Charge any additional fees, or credit overpayment to Deposit Account No. 20-0668.

Respectfully submitted,

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Docket No. TI-23064

For: METHODS FOR MEASURING DMD LOW SPATIAL UNIFORMITY

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

22 November 2004

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Charles A. Brill — 22 Nov. 2004

Charles A. Brill — Date

Dear Sir:

The following Appeal Brief is respectfully submitted in connection with the above-identified application in response to the Final Rejection mailed 20 May 2004. Please charge all required fees, including any extension of time fees, to the deposit account of Texas Instruments Incorporated, Deposit Account No. 20-0668.

REAL PARTY IN INTEREST

The real party in interest is Texas Instruments Incorporated, to whom this application is assigned.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to the Applicant's legal representative.

STATUS OF THE CLAIMS

This application was filed on 21 December 2000 with thirteen claims, two of which were written in independent form. Claim 10 was amended on 5 March 2004 to cast it in independent form in response to an indication by the Examiner that it would be allowable if re-written in independent form. Claims 12 and 13 were amended on 5 March 2004 to depend from amended Claim 10. Claims 1, 2, 3, 7, 8, and 10 were amended on 20 August 2004 to improve the consistency with which the terms of the claims were used.

The true status of the claims is not clearly indicated by either of the Official Actions. Both the Official Action Summaries of 7 October 2003 and 20 May 2004 and the text of both of the Official Actions indicate that Claims 1-10 were rejected and 11-13 were objected to. The text of both Official Actions fails to apply the prior art of record to the limitations of Claim 10. The text of both Official Actions states Claims 10-13 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim.

Claim 10 was in fact rewritten in independent form by the amendment filed 5 March 2004, and Claims 11-13 continue to depend from Claim 10. The Examiner stated, "Applicant's argument in view of 35 USC 103 has been fully considered but they are not persuasive. The claims rejections have been maintained."

As all of the claims in the application are rejected, the applicant appeals the rejection of all Claims 1-13, all of the claims in the application.

STATUS OF THE AMENDMENTS

An amendment after the final rejection was filed on 20 August 2004. No response to that amendment has been received by the applicant, and none is available on

PAIR. As the amendment after final did not narrow the claims and was not made for the purpose of patentability, but merely to improve the consistency with which the terms of the claims were used, and therefore clearly would not require a further search by the Examiner or new grounds of rejection, this Appeal Brief is submitted under the assumption that the amendment has been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

The present application teaches a method of measuring the uniformity of the reflectivity across the surface of a DMD (page 7, lines 20-23). In order to accurately measure the reflectivity across the surface of the DMD, the non-uniform effects of the lighting, optics, and mirror tilt angle must be compensated (id.).

The specification, from line 12 of page 10 through line 21 of page 12, in conjunction with Figure 4, describes an embodiment of the invention recited by Claim 1. "Step 1 is to generate a reference surface gain correction map for the test device. This is used to map out the non-uniformities of the test device associated with the system optics, illumination source, and mirror tilt angle effects. This calibration or correction image is generated by stepping a small region of pixels (typically 50x50 pixels 510 located at the center of the DMD 500) in a grid pattern 520 as shown in Figure 5, to various location[s] in the field-of-view of the device and recording the reflectance of the small region at the different positions. Here, the small set of pixels at the center of the DMD is moved to the various locations through the optical field and data is recorded, as indicated. The number of steps in this mapping process depends entirely on the size of the DMD under test. Then the full reference surface gain correction image is generated by interpolating between the grid points. It is assumed that this small region of mirrors has a constant

reflectivity and therefore any deviation in the correction image is due to lighting, optics, and mirror tilt angle non-uniformities.

"In step 2, a test image is captured for the device under test. For larger devices this is accomplished in smaller frames, each of which covers a portion of the overall device.

"In step 3, a median filter is applied to the captured frame of data to remove all random noise and other high frequency components, leaving only the data for low spatial frequency variations. The image is filtered by applying a 21x21 pixel smoothing filter to remove the high frequency effects of individual mirrors. The remaining image is one in which each value represents the average gray scale intensity of its surrounding 21x21 pixel region.

"The data of interest in this test is that for the reflective non-uniformity of the mirrors. Therefore, in step 4 the filtered test data is multiplied by the earlier generated surface gain correction reference map to flatten the test surface. This flattened image shows only the non-uniformities due to the reflectance of the mirrors.

"In step 5, the process of capturing, filtering, and flattening the test image (of steps 2-4) is repeated for each frame of the test device. These frames are then stitched together to form the overall test image and then an average of the frames is taken to remove the discontinuities between frames, leaving a flat plane.

"Once this correction process is applied to the test image, the resulting image is that of the low spatial frequency uniformity of the mirrors. Variation or defects of mirror reflectivity can be caused by smudges, scratches, and particles on the surface of the device that attenuate the light. These defects can be automatically detected by

performing a "blob" analysis that is a standard procedure for typical machine vision testers."

The specification, from line 10 of page 13 through line 2 of page 16, teaches the embodiments recited by independent Claims 7 and 10.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether Claims 1-10 are unpatentable under 35 U.S.C. § 103 (a) over U.S. Patent No. 6,310,650 to Johnson *et al.* in view of U.S. Patent No. 5,485,279 to Yonemitsu *et al.*
2. Whether Claims 10-13 are dependent upon a rejected base claim.

ARGUMENT

Ground of Rejection 1:

Whether Claims 1-10 are unpatentable under 35 U.S.C. § 103 (a) over U.S. Patent No. 6,310,650 to Johnson *et al.* in view of U.S. Patent No. 5,485,279 to Yonemitsu *et al.*

"A person shall be entitled to a patent unless," creates an initial presumption of patentability in favor of the applicant. 35 U.S.C. § 102. "We think the precise language of 35 U.S.C. § 102 that, 'a person shall be entitled to a patent unless,' concerning novelty and unobviousness, clearly places a burden of proof on the Patent Office which requires it to produce the factual basis for its rejection of an application under sections 102 and 103, see Graham and Adams." *In re Warner*, 379 F.2d 1011, 1016 (C.C.P.A. 1967) (referencing *Graham v. John Deere Co.*, 383 U.S. 1 (1966) and *United States v. Adams*, 383 U.S. 39 (1966)). "As adapted to *ex parte* procedure, *Graham* is interpreted as continuing to place the 'burden of proof on the Patent Office which requires it to produce

the factual basis for its rejection of an application under sections 102 and 103'." *In re Piasecki*, 745 F.2d 1468 (Fed. Cir. 1984) (citing *In re Warner*, 379 F.2d at 1016).

"The prima facie case is a procedural tool which, as used in patent examination (as by courts in general), means not only that the evidence of the prior art would reasonably allow the conclusion the examiner seeks, but also that the prior art compels such a conclusion if the applicant produces no evidence or argument to rebut it." *In re Spada*, 911 F.2d 705, 708 n.3 (Fed. Cir. 1990).

"Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy." Graham v. Deere, 383 U.S. 1, 17-18 (1966).

"To support the conclusion that the claimed combination is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed combination or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 U.S.P.Q. 972, 973 (Bd. Pat. App. & Inter. 1985).

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180

USPQ 580 (CCPA 1974). 'All words in a claim must be considered in judging the patentability of that claim against the prior art.' In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)." MPEP § 2143.03.

The Examiner has failed to meet the duty of presenting a prima facie obviousness rejection. Claim 1 was rejected under 35 U.S.C. § 103(a) as being anticipated by U.S. Patent No. No. 6,310,650 to Johnson et al. ("Johnson") in view of U.S. Patent No. 5,485,279 to Yonemitsu et al. ("Yonemitsu"). The applicant respectfully disagrees.

Claim 1:

Claim 1 recites, "correcting said captured test image to remove DMD mirror tilt angle non-uniformities from said captured test image."

The Examiner stated, "Johnson discloses, . . . Correcting said test image to remove DMD mirror tilt angle non-uniformities from said test image, . . . (note fig. 8 block 206, the examiner interprets non-desirable characteristic as non-uniformities, captured image identifies transformation function to correct and remove non-uniformities)."

Johnson teaches, "In accordance with the above, FIG. 8 shows a flow diagram of an illustrative method for calibrating a display. . . . Control is then passed to element 204. Element 204 determines if the capture image has one or more non-desirable characteristics. Control is then passed to element 206. Element 206 identifies a transformation function that can be used to process an input video signal and provide a processed input video signal to selected projectors to reduce the non-desirable characteristics."

While the Examiner "interprets non-desirable characteristic" to include "correcting said test image to remove DMD mirror tilt angle non-uniformities from said test image," the Examiner clearly is using impermissible hindsight gleaned from the applicant's own disclosure to reach this interpretation.

Johnson teaches, "This invention relates to calibrating displays, and more particularly, to calibrating tiled projection displays that use multiple projectors to produce larger and/or higher resolution images." Johnson goes on to describe a variety of uses and historical applications of multiple projector systems before stating, "When two images are projected side-by-side on a single screen, there is normally a seam between the images. The final display image will either appear as two images placed side-by-side with a gap in between or, if the images are made to overlap on a single screen, there will be a bright line where the two images overlap. Because of the inconsistencies in conventional cameras, video processing, delivery channels, displays and, specifically, projectors, it is exceedingly difficult to perfectly match the resultant video images so that no tiling artifacts appear among the images. If the images are brought very close together on the same screen, there is typically both gaps and overlaps at each seam." (Column 1, lines 45-57).

After describing several approaches to identifying and compensating for various tiling artifacts, Johnson states "Since each artifact must be manually identified by a user, the process of calibrating an entire display can be time consuming and tedious. This is particularly true since many displays require periodic re-calibration because the performance of their projectors and/or other hardware elements tend to change over time. In view of the foregoing, it would be desirable to have a display that can be calibrated

and re-calibrated with less manual intervention than is required by Inova et al. and others." (Column 2, lines 27-35).

Thus, Johnson teaches "a tiled display that can be calibrated and recalibrated with a minimal amount of manual intervention. To accomplish this, the present invention provides one or more cameras to capture an image of the display screen. The resulting captured image is processed to identify any non-desirable characteristics including visible artifacts such as seams, bands, rings, etc. Once the non-desirable characteristics are identified, an appropriate transformation function is determined. The transformation function is used to pre-warp the input video signal such that the nondesirable characteristics are reduced or eliminated from the display. The transformation function preferably compensates for spatial non-uniformity, color non-uniformity, luminance non-uniformity, and other visible artifacts."

All three of the artifacts mentioned by Johnson, i.e. seams, bands, and rings, are created by tiled displays—that is, but images created by multiple projectors whose images are abutted or overlapped. A casual reading of Johnson confirms that its teachings are limited to the identification and correction of artifacts created by tiled displays.

The Examiner further stated, "Johnson does teach correcting a captured test image to remove DMD mirror tilt angle non-uniformities (note col. 5, lines 13-20 and 33-61). Johnson's system projector uses DMD device, Johnson col. 5 lines 55-61 describes the rotational state of DMD mirror, wherein the projection can create distortion. The examiner interprets this as DMD mirror tilt angle non-uniformities."

The Examiner's statement is misleading and clearly goes beyond the teachings of Johnson. Johnson does not show, teach, or suggest "correcting a captured test image to remove DMD mirror tilt angle non-uniformities" as stated by the Examiner.

Johnson teaches, "The displays may be projection displays which use CRT, LCD, DMD, CMOS-LCD or any other type of imaging device, and may be front or rear projection types" (column 5, lines 23-25).

Johnson does not suggest the rotational state of the DMD mirror can create distortion. Johnson states, "Depending on the rotational state (e.g. +/- 10 degrees for on/off) of each mirror on the DMD, the light from the DMD 10 is directed into the pupil of the projection lens (on) or away from the pupil of the projection lens (off)" (column 5, lines 55-59).

Johnson does not show, teach, or suggest the rotational state of the DMD mirrors can cause distortion, but states "A multiple-element projection cell magnifies the image oming off the DMD 10, at the desired MTF, lateral color, and distortion" (column 5, lines 59-61).

The Examiner has failed to indicate any teaching in Johnson or Yonemitsu that would lead one of ordinary skill in the art to modify Johnson which teaches capturing an image that is "processed to identify any non-desirable characteristics, including visible artifacts such as seams, bands, rings, etc." and applying an "appropriate transformation function" to "pre-warp the input video signal that is provided to the display such that the non-desirable characteristics are reduced or eliminated from the display" to achieve the recited limitation of "correcting said captured test image to remove DMD mirror tilt angle non-uniformities from said captured test image."

Claim 1 further recites, "multiplying said captured test image by said reference surface correction image map to produce a low spatial uniformity result image." The Examiner stated, "Multiplying said test image by said correction reference image to produce a low spatial uniformity result image (instant application cites this step performs flattening of surface fig. 4, step 4, Johnson col. 18 lines 35-40, selects flatten field image from algorithm entered)."

The applicant respectfully submits the Examiner has misinterpreted Johnson's teachings. Johnson, in lines 35-40 of column 18 states, "The algorithm is entered at element 400, wherein control is passed to element 402. Element 402 sequentially inputs one or more input signals that correspond to a flat field image of varying intensity to each projector. Control is then passed to element 404. Element 404 captures a capture image of selected flat field images." Thus, in direct contradiction of the recitation in Claim 1 of "multiplying said captured test image by said reference surface correction image map to produce a low spatial uniformity result image," Johnson teaches inputting flat field image signals to each projector.

Claim 1 further recites, "extracting low frequency non-uniformity defect data from the result image." The Examiner stated, "Johnson is silent disclosing extracting low frequency non-uniformity defect data from the result image. However, Yonemitsu discloses extracting low frequency non-uniformity defect data from the result image (note col. 14, lines 35-40)."

The passage of Yonemitsu cited by the Examiner states, "Accordingly, the data of a predicted macroblock produced by the motion compensating circuit 86 does not coincide exactly with the data of the corresponding macroblock obtained by DCT of data

motion-compensated by means of the motion compensating circuit 64 of the encoder 7 (or by means of the motion compensating circuit 76 of the decoder 9), followed by extraction of the low-frequency components of the output of the motion compensating circuit 64 and subjecting the low-frequency components to IDCT." While Yonemitsu does use the words "extraction" and "low-frequency components," Yonemitsu is teaching methods "Reproducing an input image of reduced resolution with respet to the vertical and horizontal directions in high picture quality by processing a coded bit stream of normal resolution" (abstract of Yonemitsu). The two references appear to be unrelated and certainly fall far short of a suggestion in the art to combine or modify the teachings of Johnson or Yonemitsu to achieve the limitations recited by Claim 1. The Examiner has failed to "present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references" as required by *Ex parte Clapp*.

The Examiner's rejection of Claim 1 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claim 2:

Claim 2 recites, "stepping a small 50x50 pixel region of DMD mirrors having constant reflectivity from point to point in a grid pattern over the field of view of the test DMD;" and "recording the intensity data at each of said points in said grid pattern." With respect to Claim 2, the Examiner stated, "Johnson and Yonemitsu discloses,

Stepping a small 50x50 pixel region of DMD mirrors having constant reflectivity from point to point in a grid pattern over the field of view of the test DMD (note col. 5 lines 32-40); Recording the intensity data at each of said points in said grid pattern (col. 5 lines 42-45)."

The applicant respectfully submits the Examiner has failed to reference any teaching in either Johnson or Yonemitsu to support the Examiner's position.

Lines 32-40 of column 5 of Johnson state, "An illustrative projector 8 is shown in FIG. 2, and preferably uses one Digital Micromirror Device (DMD) 10. DMD devices typically include an array of electronically addressable, movable square mirrors that can be electrostatically deflected to reflect light. The use of a DMD device can provide a lightweight, reliable, digital display with a wide viewing angle and good picture clarity. Further, some DMD devices meet various MIL-STD-810 environmental and stress requirements, and can display color graphic, text and video data at various frame rates." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, Stepping a small 50x50 pixel region of DMD mirrors having constant reflectivity from point to point in a grid pattern over the field of view of the test DMD (note col. 5 lines 32-40)."

Lines 42-45 of column 5 of Johnson state, "The projector 8 also preferably includes various optical elements to properly prepare the incoming illuminations, illuminate the DMD 10, and project the outgoing image." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, . . . Recording the intensity data at each of said points in said grid pattern (note col. 5 lines 42-45)."

The Examiner's rejection of Claim 2 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claim 3:

Claim 3 recites, "capturing said test image in smaller frames; removing high spatial non-uniformity components using a 21x21 pixel smoothing filter; stitching said frames together to form a full size test image; and taking average of said frames to remove said stitched image boundary discontinuities."

With respect to Claim 3, the Examiner stated, "Johnson and Yonemitsu discloses, Capturing said text image in smaller frames (note col. 6 lines 58-59); Removing high spatial non-uniformity components using a 21x21 pixel-smoothing filter (note col. 7 lines 1-8); Stitching said frames together to form a full size test image (note col. 9 lines 10-15, overlapping regions); and Taking average of said frames to remove said stitched image boundary discontinuities."

The applicant respectfully submits the Examiner has failed to reference any teaching in either Johnson or Yonemitsu to support the Examiner's position.

Lines 58-59 of column 6 of Johnson state, "The capture image is provided to the processor 52 as a feedback image via interface 64." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, Capturing said text image in smaller frames (note col. 6 lines 58-59)"

Lines 1-8 of column 7 of Johnson state, "a transformation function that can be used to process the input video stream 66 and provide processed input video signals to projectors 54 and 56 which reduce the non-desirable characteristics in the composite image. The non-desirable characteristics may include spatial non- uniformity, color non-uniformity, and/or luminance non-uniformity, but may also include other known image artifacts or irregularities." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, . . . Removing high spatial non-uniformity components using a 21x21 pixel-smoothing filter (note col. 7 lines 1-8)."

Lines 10-15 of column 9 of Johnson state, "When the display has overlapping tiles, it is contemplated that the distortion of the system may be directly determined from patterns projected on the display. For a tiled display having overlapping discrete images, a first feature may be identified in a selected overlapping region, wherein the first feature is projected by a first projector." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, . . . Stitching said frames together to form a full size test image (note col. 9 lines 10-15, overlapping regions)."

The Examiner did not cite any teaching in either reference to support his assertion Johnson and Yonemitsu disclose "Taking average of said frames to remove said stitched image boundary discontinuities" as recited by Claim 3.

The Examiner's rejection of Claim 3 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claim 4.

Claim 4 recites, "said result image is obtained for: +20° illumination relative to 0° DMD mirror tilt angle; and -20° illumination relative to 0° DMD mirror tilt angle."

With respect to Claim 4, the Examiner stated, "Johnson and Yonemitsu discloses +/- 20 degree illumination relative to 0 DMD mirror tilt angle (note col. 5 lines 55-57)."

The applicant respectfully submits the Examiner has failed to reference any teaching in either Johnson or Yonemitsu to support the Examiner's position.

Lines 55-57 of column 5 of Johnson state, "Depending on the rotational state (e.g. +/-10 degrees for on/off) of each mirror on the DMD, the light from the DMD 10 is directed into the pupil of the projection lens (on) or away from the pupil of the projection lens (off)." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses +/- 20 degree illumination relative to 0 DMD mirror tilt angle (note col. 5 lines 55-57)."

The Examiner's rejection of Claim 4 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claim 7:

Claim 7 recites, "A test method for measuring the low spatial uniformity of a DMD, comprising the steps of: capturing a test image; developing a correction reference surface image which conforms to the average surface of said captured test image; developing a gain factor correction image; multiplying said captured test image by said

gain factor correction image to provide a flattened low spatial uniformity result image; and extracting the low frequency non-uniformity defect data from said result image."

The Examiner is silent with respect to any teaching in either Johnson or Yonemitsu of either developing step. The Examiner therefore has failed to meet the burden of presenting a prima facie case of obviousness.

Claim 7 further recites, "multiplying said captured test image by said gain factor correction image to provide a flattened low spatial uniformity result image." The Examiner stated, "Johnson discloses, . . . Multiplying said test image by said correction reference image to produce a low spatial uniformity result image (instant application cites this step performs flattening of surface fig. 4, step 4, Johnson col. 18 lines 35-40, selects flatten field image from algorithm entered)."

The applicant respectfully submits the Examiner has misinterpreted Johnson's teachings. Johnson, in lines 35-40 of column 18 states, "The algorithm is entered at element 400, wherein control is passed to element 402. Element 402 sequentially inputs one or more input signals that correspond to a flat field image of varying intensity to each projector. Control is then passed to element 404. Element 404 captures a capture image of selected flat field images." Thus, in direct contradiction of the recitation in Claim 7 of "multiplying said captured test image by said gain factor correction image to provide a flattened low spatial uniformity result image," Johnson teaches simply inputting flat field image signals to each projector.

Claim 7 further recites, "extracting the low frequency non-uniformity defect data from said result image." The Examiner stated, "Johnson is silent disclosing extracting low frequency non-uniformity defect data from the result image. However, Yonemitsu

discloses extracting low frequency non-uniformity defect data from the result image (note col. 14, lines 35-40)."

The passage of Yonemitsu cited by the Examiner states, "Accordingly, the data of a predicted macroblock produced by the motion compensating circuit 86 does not coincide exactly with the data of the corresponding macroblock obtained by DCT of data motion-compensated by means of the motion compensating circuit 64 of the encoder 7 (or by means of the motion compensating circuit 76 of the decoder 9), followed by extraction of the low-frequency components of the output of the motion compensating circuit 64 and subjecting the low-frequency components to IDCT." While Yonemitsu does use the words "extraction" and "low-frequency components," Yonemitsu is teaching methods "Reproducing an input image of reduced resolution with respet to the vertical and horizontal directions in high picture quality by processing a coded bit stream of normal resolution" (abstract of Yonemitsu). The two references appear to be unrelated and certainly fall far short of a suggestion in the art to combine or modify the teachings of Johnson or Yonemitsu to achieve the limitations recited by Claim 7. The Examiner has failed to "present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references" as required by *Ex parte Clapp*.

The Examiner's rejection of Claim 7 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claim 8:

Claim 8 recites, "capturing said test image in smaller frames; removing high spatial non-uniformity components using a 21x21 pixel smoothing filter; stitching said frames together to form a full size test image; and taking average of said frames to remove said stitched image boundary discontinuities."

With respect to Claim 8, the Examiner stated, "Johnson and Yonemitsu discloses, Capturing said text image in smaller frames (note col. 6 lines 58-59); Removing high spatial non-uniformity components using a 21x21 pixel-smoothing filter (note col. 7 lines 1-8); Stitching said frames together to form a full size test image (note col. 9 lines 10-15, overlapping regions); and Taking average of said frames to remove said stitched image boundary discontinuities."

The applicant respectfully submits the Examiner has failed to reference any teaching in either Johnson or Yonemitsu to support the Examiner's position.

Lines 58-59 of column 6 of Johnson state, "The capture image is provided to the processor 52 as a feedback image via interface 64." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, Capturing said text image in smaller frames (note col. 6 lines 58-59)"

Lines 1-8 of column 7 of Johnson state, "a transformation function that can be used to process the input video stream 66 and provide processed input video signals to projectors 54 and 56 which reduce the non-desirable characteristics in the composite image. The non-desirable characteristics may include spatial non- uniformity, color non-uniformity, and/or luminance non-uniformity, but may also include other known image artifacts or irregularities." This in no way supports the Examiners assertion "Johnson and

Yonemitsu discloses, . . . Removing high spatial non-uniformity components using a 21x21 pixel-smoothing filter (note col. 7 lines 1-8)."

Lines 10-15 of column 9 of Johnson state, "When the display has overlapping tiles, it is contemplated that the distortion of the system may be directly determined from patterns projected on the display. For a tiled display having overlapping discrete images, a first feature may be identified in a selected overlapping region, wherein the first feature is projected by a first projector." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses, . . . Stitching said frames together to form a full size test image (note col. 9 lines 10-15, overlapping regions)."

The Examiner did not cite any teaching in either reference to support his assertion Johnson and Yonemitsu disclose "Taking average of said frames to remove said stitched image boundary discontinuities" as recited by Claim 8.

The Examiner's rejection of Claim 8 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claim 9.

Claim 9 recites, "said result image is obtained for: +20° illumination relative to 0° DMD mirror tilt angle; and -20° illumination relative to 0° DMD mirror tilt angle."

With respect to Claim 9, the Examiner stated, "Johnson and Yonemitsu discloses +/- 20 degree illumination relative to 0 DMD mirror tilt angle (note col. 5 lines 55-57)."

The applicant respectfully submits the Examiner has failed to reference any teaching in either Johnson or Yonemitsu to support the Examiner's position.

Lines 55-57 of column 5 of Johnson state, "Depending on the rotational state (e.g. +/-10 degrees for on/off) of each mirror on the DMD, the light from the DMD 10 is directed into the pupil of the projection lens (on) or away from the pupil of the projection lens (off)." This in no way supports the Examiners assertion "Johnson and Yonemitsu discloses +/- 20 degree illumination relative to 0 DMD mirror tilt angle (note col. 5 lines 55-57)."

The Examiner's rejection of Claim 9 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art. For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Claims 10-13.

Claim 10 recites, *inter alia* "developing a correction reference surface image which conforms to the average surface of said captured test image" comprising "using said representative image data to generate a set of 2nd order equations; and using said equations to generate a reference surface having only 2nd order variations."

The Examiner stated, "Regarding claim 10, the prior art fails to teach correction reference surface provide a representative image, using image data to generate a second order equation and second order variations."

The Examiner's rejection of Claim 10 as unpatentable over Johnson in view of Yonemitsu is unsupported by the prior art as indicated by the Examiner's own words.

For this reason, the Examiner has not met the burden of presenting a prima facie case of obviousness. Therefore, the rejection under 35 U.S.C. § 103(a) is defective and should be withdrawn.

Ground of Rejection 2:

Whether Claims 10-13 are dependent upon a rejected base claim.

Claims 10-13 were objected to as being dependent upon a rejected base claim, but the Examiner stated Claims 10-13 would be deemed allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The applicant respectfully submits Claim 10 was amended to be in independent form by amendment filed on 5 March 2004. Claim 10 therefore clearly is not dependent upon a rejected base claim as asserted by the Examiner. Claim 10 should be deemed allowable in its current form.

CONCLUSION

For the foregoing reasons, Appellants respectfully submit that the Examiner's final rejection of Claims 1-10 and objection to Claims 10-13 is improper, and it is respectfully requested that the Board of Patent Appeals and Interferences so find and reverse the Examiner's rejection.

Please charge any fees necessary in connection with the filing of this paper, including any necessary extension of time fees, to Deposit Account No. 20-0668 of Texas Instruments Incorporated.

Respectfully submitted,

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CLAIMS APPENDIX

1. (Previously presented) A test method for measuring the low spatial uniformity of a DMD, comprising the steps of:

building a reference surface correction image map;

capturing a test image;

correcting said captured test image to remove DMD mirror tilt angle non-uniformities from said captured test image;

further correcting said captured test image to remove system illumination and optics non-uniformities from said captured test image;

multiplying said captured test image by said reference surface correction image map to produce a low spatial uniformity result image; and

extracting low frequency non-uniformity defect data from the result image.

2. (Previously presented) The test method of Claim 1 wherein said reference surface correction image map is formed by means of a light mapping process, comprising the steps of:

stepping a small 50x50 pixel region of DMD mirrors having constant reflectivity from point to point in a grid pattern over the field of view of the test DMD;

recording the intensity data at each of said points in said grid pattern; and

performing a bi-directional interpolation between said grid points in two dimensions over image to provide said reference surface correction image.

3. (Previously presented) The test method of Claim 1 wherein said captured test image is prepared by means of:

capturing said test image in smaller frames;

removing high spatial non-uniformity components using a 21x21 pixel smoothing filter;

stitching said frames together to form a full size test image; and

taking average of said frames to remove said stitched image boundary discontinuities.

4. (Original) The test method of Claim 1 wherein said result image is obtained for:

+20° illumination relative to 0° DMD mirror tilt angle; and

-20° illumination relative to 0° DMD mirror tilt angle.

5. (Original) The test method of Claim 4 wherein said result image isolates and extracts:

high spatial frequency defects;

stitched frame boundary discontinuities;

DMD mirror tilt angle non-uniformities; and

low frequency illumination source and optics non-uniformities.

6. (Original) The test method of Claim 4 wherein:

said result image is flattened;

said result image consists essentially of data representing the DMD mirror reflectivity non-uniformities.

7. (Previously presented) A test method for measuring the low spatial uniformity of a DMD, comprising the steps of:

capturing a test image;

developing a correction reference surface image which conforms to the average surface of said captured test image;

developing a gain factor correction image;

multiplying said captured test image by said gain factor correction image to provide a flattened low spatial uniformity result image; and

extracting the low frequency non-uniformity defect data from said result image.

8. (Previously presented) The test method of Claim 7 wherein said captured test image is prepared by means of:

capturing said test image in smaller frames;

removing high spatial non-uniformity components using a 21x21 pixel smoothing filter;

stitching said frames together to form a full size test image; and

taking average of said frames to remove said stitched image boundary discontinuities.

9. (Original) The test method of Claim 7 wherein said result image is obtained for:

+20° illumination relative to 0° DMD mirror tilt angle; and

-20° illumination relative to 0° DMD mirror tilt angle.

10. (Previously presented) A test method for measuring the low spatial uniformity of a DMD, comprising the steps of:

capturing a test image;

developing a correction reference surface image which conforms to the average surface of said captured test image; wherein said correction reference surface image is formed by:

performing a 3x3 pixel lowpass filtering of said test image;

sub-sampling of said filtered image to provide a representative image having fewer rows and columns;

using said representative image data to generate a set of 2nd order equations; and

using said equations to generate a reference surface having only 2nd order variations;

developing a gain factor correction image;

multiplying said captured test image by said gain factor correction image to provide a flattened low spatial uniformity result image; and

extracting the low frequency non-uniformity defect data from said result image.

11. (Original) The test method of Claim 10 wherein said gain factor correction image is formed from said reference surface data; such that

a flatten image plane results when said reference surface data is multiplied by said gain factor correction image data.

12. (Previously presented) The test method of Claim 10 wherein said result image isolates and extracts:

high spatial frequency defects;

stitched frame boundary discontinuities;

DMD mirror tilt angle non-uniformities; and

low frequency illumination source and optics non-uniformities.

13. (Previously presented) The test method of Claim 10 wherein:

said result image is flattened;

said result image consists essentially of data representing the DMD mirror reflectivity non-uniformities.